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Issues for the 1990's: TECHNOLOGY

Alternative Fuels: Ethanol

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Issue. Alternative fuels such as ethanol contribute to at least two U.S. policy goals: improving environmental quality and enhancing farm income. Using ethanol-blended fuels reduces carbon monoxide emissions in motor vehicles. Ethanol also creates markets for farm commodities, particularly corn. But, ethanol is costly to produce and depends on Federal and State incentives to compete with its nonrenewable competitors. The issue involves the tradeoff between the current and future cost of incentives and the value of alternative fuels toward meeting policy goals.

Context. The Clean Air Act Amendments of 1990 (CAA) create an opportunity for expanding the use of alternative fuels. However, alternative fuels are relatively costly to produce, so they represent less than 1 percent of U.S. transportation fuel use. The demand for the best known alternative fuel, ethanol, is enhanced by a mix of Federal and State incentives. While currently producing about 900 million gallons of ethanol per year, the ethanol industry continues to depend on Federal and State incentives to remain viable. An income tax credit of 54 cents per gallon of alcohol is allowed to blenders of alcohol and gasoline for use as a fuel. Or, a 5.4-cent-per-gallon exemption from the Federal excise tax on gasoline is allowed on the sale of 10-percent alcohol and 90-percent motor fuel blends. The 10-percent blend requirement translates into an incentive equal to 54 cents per gallon of ethanol. In addition, a "Small Producers Credit" equal to 10 cents per gallon is available to producers with annual production capacity of up to 30 million gallons.

At Stake. Using ethanol-blended fuels rather than conventional gasoline can reduce air pollutants like carbon monoxide, creating economic benefits by cutting health care costs. While use of 10-percent ethanol blends, which are more volatile than gasoline, may contribute to the ozone problem, there is limited information regarding the effects of different ethanol blends on fuel volatility. For example, neat ethanol (100-percent ethanol) is less volatile than gasoline. Blending ETBE (ethyl tertiary butyl ether), manufactured from ethanol, with gasoline also reduces fuel volatility and ozone problems.

Increasing ethanol production also creates markets for farmers and can increase farm income. Ethanol production, expanding from an expected 1.2 billion gallons per year to 2 billion gallons per year in 1995, could increase farm income by about $170 million. A 5-billion-gallon per year production level could increase farm income by $1 billion or about 2 percent of 1991 net farm income. When government set-aside requirements are relaxed to soften the effects on corn prices, an increase of ethanol production to 2 billion and 5 billion gallons per year could reduce annual government deficiency payments by $7 million and $900 million, respectively. The $7 million decrease in deficiency payments reflects the smaller corn price impacts due to relaxed set-aside requirements.

Added ethanol production could also increase U.S. exports. Over 90 percent of all U.S. corn gluten feed (CGF), an ethanol byproduct livestock feed, is exported to the European Community. Total 1991 CGF exports exceeded 6 million tons with a value in excess of $800 million. Ethanol production climbing from 1.2 billion gallons to 2 billion gallons per year could spur CGF exports by 2 million tons per year, increasing the total value of U.S. CGF exports by $200 million, which was 0.5 percent of total U.S. agricultural exports in 1991.

However, tax exemptions also distort the allocation of resources throughout an economy. If markets reflected all costs, these distortions would create a burden to society, with no economic justification for supporting Federal assistance to ethanol. However, market failures do exist. For example, the price of gasoline does not fully reflect the true costs to society, including air pollution, of petroleum use. In addition, farm commodity programs distort agricultural production decisions. Because such distortions exist, incentives for ethanol may improve the overall welfare of society, depending upon true costs and benefits of gasoline and its alternatives.

Alternatives. Several public policy choices relate to ethanol production:

Relax minimum blend requirements. The minimum 10-percent blend requirement for receiving the Federal excise tax exemption could be relaxed to provide the flexibility required to meet regional demands under the Clean Air Act. While the use of 10-percent ethanol blends is more volatile than gasoline and may contribute to the ozone problem, there is limited information regarding the effects of different ethanol blends on fuel volatility. The national energy strategy bill provides added, but still limited, flexibility in the tax treatment of ethanol-blended fuels.

Relax set-aside requirements. Increases in the cost of producing ethanol or increases in consumer food costs because of higher corn prices could be mitigated if the set-aside requirements associated with current farm programs were relaxed. In 1991, for example, almost 30 million acres of cropland were idled under annual Federal acreage reduction programs, about 7.5 million of them idled under the corn program. The idled corn acres alone represent almost 2 billion gallons of potential ethanol.

Encourage research and development of ethanol byproducts. Development of ethanol byproducts is the most potentially profitable area of research. The price of ethanol is tied to other energy sources, feedstock (corn) costs are dictated by alternative uses, and production cost reductions are limited by the physical process involved in ethanol production. Byproduct revenues are not bound by these restrictions. High-value, low-volume ethanol byproducts, such as citric acid or sorbitol, may be removed as technology becomes available. Converting carbon dioxide, currently a low-value ethanol byproduct, into acetic acid could considerably reduce ethanol production costs.

Expand current levels of research and development in biomass conversion. Near- and long-term ethanol research and development have a different focus. While near-term efforts have focused on the ethanol production facility itself, in the long term, the industry must adopt technologies that use a broader set of feedstocks. An active research area involves breaking down a variety of biomass materials into sugars that can then be fermented into ethanol. Breakthroughs in biomass pretreatment and conversion allow higher ethanol yields from grains by converting the fiber portion of the grain into ethanol. Crops such as energy sorghum and switchgrass, as well as cellulosic material such as bagasse, corn stover, or wheat straw, may be converted into ethanol. These technologies could reduce operating and capital costs to less than 80 cents per gallon.

Agenda. The CAA creates an opportunity for expanding the use of alternative fuels. Questions remain about the role of ethanol in meeting CAA requirements and whether alternative fuels can compete in price with nonrenewable alternatives. The future of renewable alternative fuels depends on policy initiatives that encourage the research and development of technologies that can reduce production costs and the cost of Federal and State incentives.

Information Sources. Three U.S. Dept. of Agriculture, Economic Research Service, reports: Neil Hohmann and C. Matthew Rendlemann, *Emerging Technologies in Ethanol Production*, AIB-663, Jan. 1993, Robert House, Mark Peters, Harry Baumes, and W. Terry Disney, *Ethanol and Agriculture: Effect of Increased Production on Crop and Livestock Sectors,* AER-667, May 1993, and Margot Anderson, *Ethanol Production, Corn Gluten Feed, and EC Trade*, AIB-677, July 1993. Call authors (Hrubovcak and Hohmann) for ethanol information relating to the environment, agriculture, and trade.

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Regulating Bio-Engineered Foods

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Issue. Use of biotechnology can increase the quality and quantity of food. Although biotechnology is being used to develop many food products, there may be delays in providing such products to consumers. Concerns have been raised about effects of biotechnology on food and environmental safety, and the structure of the agricultural industry. Adequacy of laws and regulations covering agricultural biotechnology to protect public interests has been questioned. The General Accounting Office has identified potential conflicts of oversight jurisdiction between government agencies as an impediment to safe development and marketing of biotechnology products. The U.S. Department of Agriculture (USDA) is devising a management strategy to institute a clear regulatory authority and review process.

Context. Biotechnology can be broadly defined as the use of living organisms to solve problems or to make useful products. This definition includes traditional plant and animal breeding methods, and bioprocessing, such as fermentation. The new biotechnology is the application of cellular and molecular biology to meet human needs, a definition that includes use of monoclonal antibodies, cell culture, biosensors, antisense, and genetic engineering (recombinant DNA and cell fusion) technologies. Biotechnology can be used to increase a plant's ability to control pests and disease, tolerate environmental stress, and enhance food quality, such as flavor, texture, shelf-life, and nutritional content. Biotechnology can be used for animals to promote growth and develop vaccines. Other uses include increasing food processing efficiency and developing more effective diagnostic techniques for testing food safety.

Many bio-engineered food products are being developed. Commercial success of these foods will depend on industry and farmer profits, public acceptance of biotechnology products (consumer demand), and the regulatory environment. Lack of confidence in the effectiveness and timeliness of existing safety regulations has caused delays and additional costs. Consumers, biotechnology industry representatives, researchers, environmentalists, agricultural producers, and food processors have expressed concern about current regulatory policies. Confusion exists over which agencies will exercise jurisdiction over the many elements of developing, testing, and marketing bio-engineered foods. Primary agencies involved are the Food and Drug Administration (FDA), the Environmental Protection Agency (EPA), and the USDA.

At Stake. Many technologies have helped increase productivity and cost efficiency in agricultural production, as well as provide consumers with a cheaper, higher quality, and more diverse food supply. Such benefits may not be realized with agricultural biotechnology unless public concerns are addressed and a well-articulated regulatory policy is established. There will be no market for the products of biotechnology without public acceptance of the products.

Delays in resolving intellectual property rights (patent) issues and in establishing clear regulations for field testing and product marketing could be costly. Firms have already invested over $1 billion in agricultural biotechnology, and Federal investment is expected to be about $600 million between 1991 and 1993. Lack of international harmonization in patenting and regulating bio-engineered food products could restrict international trade and harm U.S. competitiveness. Companies may reduce investment if the regulatory environment remains uncertain.

Use of biotechnology could variously affect food safety. Biotechnology methods can be used to develop quicker and more efficient techniques for detecting and reducing microbial contamination and concentrations of allergens and toxins in foods. However, use of biotechnology may cause unintended changes in the concentration in foods of allergens, toxins, and nutritional content. Traditional breeding methods pose a similar risk. Ethical concerns have been raised about the transfer of human and animal genes into plants and animals different from the host species (transgenics).

Dependence on pesticides and fertilizers might be reduced if plants were developed to resist pests and disease, and to more efficiently use soil nitrogen. In addition, plants developed with the ability to withstand such environmental stress as drought might prove less demanding on natural resources. One environmental concern is that adoption of herbicide-resistant crops may encourage continued use of chemicals, albeit less harmful chemicals in some cases. Another concern is that genetically engineered crops and animals, in competing with indigenous populations, may strain biodiversity and disrupt the ecological balance.

There are many issues associated with the introduction of foods produced using biotechnology, but most of the concerns would be relevant for any new agricultural technology. A technology resulting in significant changes in costs or production can cause structural changes in agricultural industries and regional shifts in production and income, as well as potentially affect environmental and food safety.

Alternatives. Clear, definitive regulatory policies for patenting, field testing, and ensuring food and environmental safety of agricultural biotechnology could reduce costs of commercializing bio-engineered foods. Biotechnology researchers and regulators generally acknowledge that biotechnology techniques are not inherently risky. Therefore, science- and risk-based regulations focusing on products of biotechnology could ensure adequate oversight.

There are several recent developments in the reformulation of regulatory policy. The FDA and the USDA's Food Safety and Inspection Service (FSIS) are establishing food safety policies for transgenic animals. The FDA has announced that food from new plant varieties developed using biotechnology will be regulated the same as food from plant varieties developed using traditional methods. USDA's Animal and Plant Health Inspection Service (APHIS) has streamlined the permit process for the field testing of certain crops for which some scientific assurance of safety exists. These decisions could reduce delays in commercialization and lower costs of product development, but only if the public, industry, and scientific community have confidence in the regulatory process.

Agenda. Agencies responsible for regulating bio-engineered foods and restructuring regulatory policy need to coordinate efforts to establish unified regulatory policies and to respond to public concerns. Efforts should include the public, industry, agricultural producers, academics, and the international community. International trade agreements need to resolve patent issues. If concerns are addressed in an open and accessible decisionmaking process, confidence in the regulatory system could be enhanced and agricultural biotechnology products would be developed to accommodate global needs.

Information Sources. Office of Technology Assessment (OTA), *A New Technological Era for American Agriculture*, Aug. 1992; Purdue Agricultural Experiment Station, *Agricultural Biotechnology: Issues and Choices*, edited by Bill Baumgardt and Marshall Martin, 1991; U.S. Government Printing Office, *Biotechnology for the 21st Century*, a report by the Federal Coordinating Council for Science, Engineering and Technology (FCCSET) Committee on Life Sciences and Health, Feb. 1992; and General Accounting Office, *U.S. Department of Agriculture: Improving Management of Cross-Cutting Agricultural Issues*, GAO/RCED-91-41, 1991.